the anatomy of the species under the heading of *Mus maurus*, Gray, has kindly drawn my attention to the fact that Mr. Ramsay had already described an Australian "*Mus Burtoni*" *, so that the name of the African one must be changed.

I would therefore suggest for the latter the name of *Mus Tullbergi*, in recognition of Prof. Tullberg's valuable paper on the Muridæ of the Cameroons, where this species appears to be so common.

XXII.—*Preliminary Notice of South-American* Tubificidæ *collected by Dr. Michaelsen, including the Description of a Branchiate Form.* By Frank E. Beddard, M.A., F.R.S.

The Oligochæta of which I give a preliminary account in the following pages were collected by Dr. Michaelsen in South America. The material was, of course, excellently preserved, and I am able therefore to give, I trust, an accurate account of the principal structural features of the new forms.

The bulk of the aquatic species which he collected prove to belong to the family Tubificidæ, and they are all new species, four of them representing a new and evidently highly characteristic South-American genus. So far as I am aware there is nothing known about the aquatic worms of this part of the world, save a few notes on an *Æolosoma* and Naids by Frenzel† in a paper devoted to the Protozoa met with in the Argentine, and the description by myself ‡ of two aquatic members of the genus *Acanthodrilus* from the Falkland Islands and of a new genus, *Kerria*, also referable to the Acanthodrilidæ, from the upper reaches of the Pilcomayo River, and, lastly, the description of "*Mandane stagnalis*" by Kinberg, from the same continent, and of one or two forms by Schmarda. The collection contains a few Naids, not sexually mature, and one or two Enchytræids. I have not yet subjected these to a careful examination. The Tubificidæ comprise five species, of which four, as already stated, belong to a new genus, for which I proposed the name *Hesperodrilus* in a note published in a recent number of 'Nature' §. The fifth species I call

* Proc. Linn. Soc. N. S. W. (2) ii. p. 553 (1887).

† "Untersuchungen über die mikroskopische Fauna Argentiniens," Arch. f. mikr. Anat. xxxviii. p. 1.

‡ "Contributions to the Anatomy of Earthworms &c.," Quart. Journ. Micr. Sci. xxx. p. 421; and "On some new Species of Earthworms from various parts of the World," Proc. Zool. Soc. 1892, p. 678 &c.

§ Jan. 25th.

Bothrioneuron americanum, sp. n.

This worm was collected in great abundance, and is described in a note by Dr. Michaelsen as having the general appearance of *Tubifex*. It was collected in the neighbourhood of Buenos Ayres.

The genus *Bothrioneuron* itself, to which I refer the present species, has been lately described by Stole *. It differs from all other Tubificidæ, except *Monopylephorus* of Levinsen † and *Vermiculus* of Goodrich ‡, in having an unpaired male orifice. In his description of *Monopylephorus* Levinsen has not referred to the spermathecal pores. As these are absent in *Bothrioneuron* it may be that the two genera are identical; but it is impossible to be certain about the matter. These three genera, moreover, agree with each other (and with *Limnodrilus* and *Clitellio*) in having only uncinate setæ; the capilliform setæ of other Tubificids are entirely absent. The principal reason which leads me to place my new species in the genus *Bothrioneuron* is the absence of spermathecæ, the absence of capilliform setæ, the presence of an integumental blood-plexus, and the existence of what Vejdovsky § has termed a "paratrium," a diverticulum of the spermiducal gland, to which, in *Bothrioneuron Vejdovskyanum*, the prostate is attached. In my species, however, the male pores are double, but the paratrium apparently resembles that of *Bothrioneuron Vejdovskyanum*. The atrium or, as I prefer to call it, spermiducal gland is wrapped in a thick glandular covering, as in the Lumbriculidæ and the Moniligastridæ. Such a coating appears to be absent from *Bothrioneuron Vejdovskyanum*. In short, there is no doubt whatever as to the specific distinctness of this worm; the only doubt is as to whether I am right in referring it to the genus *Bothrioneuron* at all. I found no trace of the peculiar spermatophores described by Stole, or, indeed, of any spermatophores at all.

HESPERODRILUS, gen. nov.

Four species of Tubificids from Valdivia, Port Stanley, and Uschuaia represent a perfectly new genus of Tubificidæ; I cannot refer them to any known genus. The most salient characters of this genus are:—

(1) The presence of capilliform setæ only in the dorsal bundles.

* "Monografie Ceskych Tubificidu," Abh. k. Böhm. Ges. 1888.

† "Systematisk-geografisk Oversigt over de nordiske Annulata &c.," Vid. Med. 1882, p. 223.

‡ "Note on a new Oligochæte," Zool. Anz. no. 408 (1892).

§ "Sur une Tubifex d'Algérie," Mém. Soc. Zool. Fr. 1891.

(2) The presence of two setæ only in each ventral bundle, of which one is uncinate, the other simple.
(3) The opening of the spermathecæ in segment xiii. behind the male pores.
(4) The fact that the sperm-duct opens independently of the spermiducal gland into the penis.

This combination of characters occurs in no other Tubificid. In fact more than one of the characters is peculiar to the present genus. The curious arrangement of the ventral setæ is peculiar, and so is the position of the spermathecæ.

It is the rule among the Tubificidæ for the sperm-duct to open into the extremity of the spermiducal gland, which has ordinarily the appearance of being a continuation of it. To this rule there has hitherto been only a single exception recorded. This exception is the remarkable genus *Branchiura* *, in which the sperm-duct opens into the lowest part of the spermiducal gland just before the latter becomes continuous with the penis. In *Hesperodrilus* the same state of affairs is met with, but the gland is not enveloped, as it is in *Branchiura*, by a thick outer coating of glandular cells; there is only the lining of cells, which are, however, extremely glandular; the distinct prostate found in so many Tubificidæ, but wanting in *Branchiura*, *Clitellio*, and *Ilyodrilus*, is also wanting in *Hesperodrilus*. As to the peculiar condition of the setæ of the ventral bundles, it might perhaps be thought that there is some error; it is so frequently the case that one of the teeth of the bifid seta is worn. In the present instance there can, I think, be no doubt about the matter; the two kinds of setæ occurred with far too great a regularity to admit of any such explanation as that suggested.

The following is a brief description of the main characters of the four species belonging to this new genus:—

1. Hesperodrilus branchiatus, sp. n.

I refer first to this species on account of its interest in being another branchiate species. This is now the second Tubificid in which organs clearly of a branchial nature exist. The other species is *Branchiura Sowerbii*, which I discovered two years ago in the "*Victoria regia*" tank at the Botanical Society's Gardens in the Regent's Park. At first I naturally supposed that I had before me an example of that worm, the habitat of which is very possibly South America; but in the

* "A new Branchiate Oligochæte, *Branchiura Sowerbii*," Quart. Journ. Micr. Sci. 1892, p. 1.

present species the branchiæ, though apparently similar in structure to those of *Branchiura*, have a different arrangement. In *Branchiura* they are dorsal and ventral, attached to the median line of the body on those aspects. In *Hesperodrilus branchiatus* they are lateral in position, being attached a little below the lateral setæ. These were, moreover, in the single specimen examined by me fewer in number; I counted only thirteen pairs. In the interior of each branchial process was a capillary loop; their length is about the diameter of the body; no doubt during life they extend on each side for a considerable distance beyond the body. It is an interesting fact that in both the present species and in *Branchiura* the branchiæ should be limited to the tail-end of the body; but a consideration of the habits of the Tubificidæ seems to explain this. It is well known that the common *Tubifex* of our streams and rivers buries its head in the mud, while the tail waves freely about in the water; this appears also to be the way with other Tubificids. Now in *Limnodrilus* the hinder segments of the body are apt to have integumental capillaries, which render the aeration of the blood easier in those segments; there is thus the first step in the formation of a special breathing organ. In *Bothrioneuron* (see above) the hinder end of the body is furnished with an exceedingly rich integumental blood-plexus, which is a further step in the same direction. Finally, we have in *Branchiura Sowerbii* and in *Hesperodrilus branchiatus* the appearance of definite branchial organs. On the other hand, in *Chætobranchus Semperi*, Bourne's gilled Naid, which presumably wanders through the water and is not largely sessile, the branchiæ are at the head end and diminish towards the tail; the same is the case with *Alma nilotica*, whose nature, however, cannot yet be regarded as certain; it may be, as has been suggested by Eisig, a Capitellid. The branchiæ of *Dero* and of *Aulophorus vagans*, if this genus be allowed as distinct from *Dero*, are at the hinder end of the body.

In other features of its organization this *Hesperodrilus* conforms to the type of structure already described as characteristic of the genus *Hesperodrilus*, though there are naturally other points of difference.

2. Hesperodrilus niger, sp. n.

The most salient external character of this species is its deep black coloration. It is a largish worm, quite an inch in length, and of a considerable thickness. I regarded it at first as probably a *Lumbriculus*. It proved, however, in dissection to be undoubtedly a member of this genus.

Its chief distinguishing character is the dark pigmentation of the dorsal surface of the body; the pigment proved on an examination of sections to be chiefly located in the peritoneum lining the dorsal side of the cœlom, thence extending for a little way into the muscular layers of the body-wall and in the opposite direction along the septa. The internal characters, apart from differences of small importance, are those of the following species.

3. Hesperodrilus albus, sp. n.

This is a small and slender species of a white colour (when preserved); its general appearance is quite that of a *Tubifex*. In addition to the peculiar characters of the ventral setæ which I referred to as characteristic of the genus, this species shows another peculiarity in those organs which I believe to be unique in the Tubificidæ. The dorsal setæ do not commence upon the first setigerous segment, but upon the second; there is thus the commencement of what Prof. Lankester has termed "cephalization," so highly characteristic of many Naids. Vaillant, in his recently published account of the Oligochæta, has united the Tubificids and the Naids into one family; this species is a further proof of the justice of this course. Not only does *Hesperodrilus* show in this particular some resemblance to the Naids, but it also shows an approach to the Lumbriculidæ. It will be remembered that in *Phreatothrix* and in *Stylodrilus Vejdovskii* the first pair of nephridia extend through a considerable number of segments, though the funnel and the external pore are, as is the rule, upon consecutive segments; in *Hesperodrilus albus* we find exactly the same state of affairs. The first pair of nephridia are in the sixth segment; thence they extend back as far as the tenth, but the external aperture is upon the sixth. The proof of this was not entirely derived from a careful putting together of a series of consecutive sections, which might possibly lead to error; in one section the course of the tube through three segments was quite plainly visible. Another mark of distinction between the Tubificidæ and the Lumbriculidæ is thus broken down. I am disposed to unite Tubificidæ, Naidomorpha, and Lumbriculidæ into one large family.

The spermathecæ of this species are extraordinarily long; the genus as a whole is characterized by the possession of long spermathecæ, but the present species and the next one have unusually long sacs, which extend through five segments. Each sac is dilated at the blind end into an oval sac, in which

lie the spermatozoa; I could find no trace of spermatophores. The duct of the spermatheca leading from this sac is long and narrow; rather more than halfway down there is a slight swelling and a kind of trap formed by a sudden change in the height of the lining epithelium; the structure is very suggestive of the spermatheca of *Marionia sphagnetorum* recently described by Michaelsen *.

4. **Hesperodrilus pellucidus**, sp. n.

This species is very like the last, differing, however, in a few small points. Its colour when preserved is brownish, instead of an opaque white. The dorsal capilliform setæ are not so long and the spermiducal gland is a little different in form. In other respects it agrees entirely with *Hesperodrilus albus*.

I conclude with a definition of the genus and the species:—

HESPERODRILUS, gen. nov.

Dorsal setæ capilliform only; ventral setæ two to each bundle, one uncinate, the other simple. Male pores on segment xii., spermathecal pores on xiii. Spermiducal gland opening into protrusible penis, together with sperm-duct; no distinct "prostate." Spermathecæ long. No spermatophores (?).

(1) **Hesperodrilus branchiatus**, sp. n.

Dorsal setæ short and slender. Posterior thirteen segments with paired branchial processes.

(2) **Hesperodrilus niger**, sp. n.

Body strongly pigmented dorsally. Dorsal setæ short and slender.

(3) **Hesperodrilus albus**, sp. n.

Dorsal setæ do not commence until segment iii. Spermiducal gland communicates with penis by a narrow tube.

(4) **Hesperodrilus pellucidus**, sp. n.

Dorsal setæ do not commence until segment iii., slender. Spermiducal gland only separated by a short constriction from penis.

* Arch. f. mikr. Anat. xxxi. pl. xxiii. fig. 2 *c*.